CLAIMS

1. A device for measuring the appearance of an object that is based on a digital camera platform design, said device comprising:

(a) a color sensor for capturing an image of an object and collecting appearance data from said object;

(b) a memory storage system for saving said captured image;

(c) a display on said device for displaying the captured image; and

(d) a CPU internal to said device allowing interpretation and processing of said appearance data to determine appearance factors for said image.

2. A device as defined in claim 1 that is a handheld device.

3. A device as defined in claim 1, wherein said sensor for capturing the image is selected from a group comprising of a CMOS sensor, a CCD sensor, and an X3 sensor based on the color separation properties of silicon.

4. A device as defined in claim 1, wherein said display device comprises an LCD panel.

5. A device as defined in claim 4, wherein said LCD panel is able to display interpretive maps of the captured image.

6. A device as defined in claim 1, wherein said object is a dental object.

7. A device as defined in claim 6, wherein said dental object comprises one of a crown, plate, bridge and replacement tooth.

8. A device as defined in claim 1, further comprising a microphone to record voice-information to describe and/or annotate the captured image of the object.

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9. A device as defined in claim 8, wherein said CPU processor links said captured image of the object with said recorded voice information describing and/or annotating said captured image of the object.

10.   A device as defined in Claim 1 further comprising a keypad for inputting textual information about the image of the object.

11.   A device as defined in Claim 11 wherein said CPU processor links said inputted textual information with said image of the object.

12.   A device as defined in Claim 9 further comprising an internal speaker to play the recorded attached voice annotations.

13.   A device as defined in Claim 1 further comprising a means for illuminating said object.

14.   A device as defined in Claim 13 wherein said illumination means comprises white light emitting diodes.

15.   A device as defined in Claim 1 further comprising a means for altering the illumination pattern and depth of focus attached on the front of said device.

16.   A device as defined in Claim 1 wherein said CPU comprises means for connecting to and communicating with a computer network.

17.   A device as defined in Claim 16 wherein said computer network is the Internet.

18.   A device as defined in Claim 16 wherein said CPU transmits said image of said object to said computer network.

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19. A device as defined in Claim 16 wherein said CPU receives software updates and enhancements from said computer network.

20. A device as defined in Claim 16 wherein said CPU receives information regarding maintenance check ups and device problem diagnoses from said computer network.

21. A handheld MAT device as defined in Claim 2, wherein said device comprises a means for calibrating said device, said calibration means comprising one or more of:

(a) a cradle for holding the MAT device, said cradle housing designed to accurately position the calibration target correctly for the MAT device

(b) providing the calibration process with a sleep mode;

(c) spatial compensation means for known and consistent spatial variations in the image;

(d) light feedback control means using camera output to modify the light source;

(e) means for implementing the concept of absolute color standards for inter-device communication;

(f) process for selecting the reference colors of the calibration standard; and/or

(g) means for signaling need for replacement of calibration color patch.

22. A device as defined in Claim 21 wherein said cradle fits over the nose of said device and serves as a stand for the device.

23. A device as defined in Claim 21 wherein either said device or said cradle is provided with a proximity switch for automatically starting the calibration device when the device is placed in the cradle and/or automatically stopping the calibration device when the device is removed from the cradle.

24. A device as defined in Claim 21 wherein said device is provided with a calibration target; said calibration target mounted in a spring loaded door located over the exit of said handheld device.

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25. A device as defined in Claim 24 further comprising an asceptic shield provided with a tongue means for pushing open said door when the shield is placed over the nose of the device.

26. A device as defined in Claim 24 wherein said calibration target is mounted on the rear of said door.

27. A device as defined in Claim 24 further comprising a proximity sensor mounted in the handpiece to detect when the door is fully closed.

28. A device as defined in Claim 21 wherein said sleep mode comprises means for changing the illumination intensity if the unit has not been used for a set period of time.

29. A device as defined in Claim 21 wherein calibration patch is provided with bar codes for identifying the calibration patch.

30. A system for conducting quality control of direct and indirect dental restorations, said method comprising:

      (a) an MAT device;

      (b) a processing unit;

(c) said MAT device comprising an input means for inputting details of features of the patient's mouth to said processing unit; and

(d) a mouth modeler comprising means for mimicking the optical and appearance properties of the canonical human mouth..

31. A system as defined in Claim 30 wherein said MAT device is a device as defined in Claim 1.

32. A system as defined in Claim 30 wherein said detail features comprise one or more of the arch size, gum color and teeth spacing.

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33.   A system as defined in Claim 30 wherein said mouth modeler comprises means for allowing the placement of the prosthesis into the mouth modeler and to measure the results using the MAT.

34.   A system as defined in Claim 30 wherein said mouth modeler comprises means for displaying the original image of the tooth.

35.   A system as defined in Claim 30 wherein said mouth modeler comprises means for deforming or morphing the original teeth.

36.   A system as defined in Claim 30 wherein said mouth modeler comprises means for comparing the appearance of the original tooth with the prosthetic tooth.

37.   A system as defined in Claim 34 wherein said comparison means comprises a displayed map using a metric.

38.   A system as defined in Claim 30 further comprising means for providing information on how to remake the prosthesis.

39.   A system for providing information regarding a tooth whitening procedure; said method comprising:

(a)   displaying to a patient a palette of colors that correspond to a range of shades of natural teeth and allowing the patient to select the shade that the patient feels most closely corresponds to the shade of the patient's teeth;

(b)   using a MAT system to determine the shade pattern of the patient's teeth; and

(c)   displaying the original image obtained by the MAT and shade map of the patients actual tooth, an image of the patient's tooth based on the selected shade, and an image of the tooth as predicted after tooth whitening.

40.   A computer aided shade design process comprising:

  (a)   an MAT system for obtaining appearance data;

  (b)   means for processing said appearance data into a shade map;

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(c)   means for allowing a user to manipulate said shade map; and

(d)   means for processing said manipulated shade map to produce a revised shade map.

41.   A computer aided shade design process wherein a said MAT system is as defined in Claim 1.

42.   A computer aided shade design process as defined in Claim 38 wherein said shade map manipulation means comprises means for selecting one or more areas of the map and changing, deleting or adding shade to said area.

43.   A computer aided shade design process as defined in Claim 40 wherein said means for processing said manipulated shade map to provide a revised shade map infers a choice of shade based on the surrounding shades.

44.   A computer aided shade design process as defined in Claim 38 further comprising a means for generating an error map by comparing said revised map to the user to the measured color information.

45.   A computer aided dental restoration design process comprising:

(a)   an MAT system for obtaining appearance data;

(b)   a three dimensional scanner for obtaining shape data;

(c)   a data interface enabling the user to select coping material and surface material for dental restoration;

(d)   a materials database providing appearance information regarding said material and/or mixing and layering of materials;

(e)   means for processing said retrieving appearance information from said materials database based on user's selection of materials

(f)   means for producing a virtual dental restoration based on said retrieved appearance information;

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(g)   means for producing a customized shade map based on said virtual dental restoration; and

(h)   means for processing said manipulated shade map to produce a revised shade map.

46.   A computer aided dental restoration design process wherein a said MAT system is as defined in Claim 1.

47.   A computer aided dental restoration design process as defined in Claim 43 wherein said shade map manipulation means comprises means for selecting one or more areas of the map and changing, deleting or adding material to said area.

48.   A computer aided dental restoration design process as defined in Claim 43 wherein said means for processing said manipulated shade map to provide a revised shade map infers a choice of shade based on the surrounding shades.

49.   A computer aided dental restoration design process as defined in Claim 43 further comprising a means for generating an error map by comparing said revised map to the user to the measured color information.

50.   A computer aided dental restoration design process as defined in Claim 43 wherein said dental restoration comprises a crown.

51.   A computer aided dental restoration design process as defined in Claim 43 further comprising means for outputting the material input information for producing said revised customized shade map.

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